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GEOLOGY AND PALÆONTOLOGY.

THE OLDEST ARTIODACTYLE.—Members of this order have been found in the upper Eocene of N. America (*Achænodon*), but none have been determined as yet from the American Suessonian or lower Eocene. A species represented by teeth from the Siderolitic beds of Switzerland has been referred to *Dichobune* (*D. campichii* Pict); but dental characters alone are not sufficient to distinguish that genus from the Perisodactyle *Phenacodontidæ*¹. Dr. Lemoine found astragali of a small Artiodactyle in the Suessonian of Reims, which he has recently ascribed to his *Lophiochærus peroni*, which he believes (Proceedings French Assoc. Adv. Sci., Montpellier, 1880) to be a suilline. I have reported an astragalus from the Wind river formation of Wyoming Territory, which is almost exactly similar to those found by Lemoine. A specimen of *Miocænus brachystomus* Cope now to be described, enables me to characterize with some degree of completeness this interesting form, which precedes in time all the known American *Artiodactyla*.

The characters of the tarsus are typically those of the Order *Artiodactyla*. The astragalus exhibits a distal trochlea which is continuous with the sustentacular facet, and which articulates with both cuboid and navicular bones.

The distal portion of the fibula is free from the tibia, and its shaft becomes very slender, but it is possible that a more perfect specimen would display it as continuous. Its distal extremity articulates with the ascending tuberosity of the calcaneum. The cuboid facet of the latter is narrow. The cuboid and navicular are distinct from each other and the cuneiforms; the mesocuneiform is shorter than the ectocuneiform, and is *cōssified with it*.

There are probably four metatarsals. The median pair are distinct, but appressed; their section together, subcircular; the lateral metatarsals are slender, the external one is wanting, but its facet on the cuboid is very small.

These characters are in general similar to those of the genus *Dichobune*, but Cuvier² does not state whether the cuneiforms are cōssified in that genus or not. They are united in *Anoplotherium*.

Miocænus differs from *Dichobune* in the presence of but one internal tubercle of the superior molars, and in the single external tubercle of the superior premolars. Both genera are referable to a family to be distinguished from the *Anoplotheriidæ* by the presence of external digits. This has been already named by Gill the *Dichobunidæ*. The genus *Lophiochærus* is not yet fully characterized, but its inferior true molars are very elongate and have their cusps connected by oblique ridges.—*E. D. Cope*.

¹ See AMERICAN NATURALIST, 1881, December.

² Ossements fossiles, v, p. 183. Gaudry Enchaînements d. Regne Animal, p. 147.

THE CHARACTERS OF THE TÆNIODONTA.—Additional material gives the following results with regard to the affinities of this suborder. There are three allied groups represented by the genera *Esthonyx*, *Tillotherium* and *Calamodon* of the American Eocenes which are equally unlike each other. *Esthonyx*, as I long since showed, is related to the existing *Erinaceus*; very nearly indeed if the dentition alone be considered. Its anterior incisor teeth are unusually developed and have, as in *Erinaceus*, long roots. One pair at least in the lower jaw has enamel on the external face only, and enjoys a considerable period of growth. The genus *Tillotherium* is (fide Marsh) quite near to *Esthonyx*. Its molars and premolars are identical in character with those of that genus, the only important difference being found in the incisors. Here, one pair above and one pair below, are faced with enamel in front only, and grow from persistent pulps as in the *Rodentia*. This character has been included by Marsh in those he ascribes to his "order" of *Tillodonta*, but as he includes *Esthonyx* in that order,¹ which does not possess the character, it is not very clear on what the supposed order reposes. The rodent character of the incisors is the only one I know of which distinguishes *Tillotherium* from the *Insectivora*. I have on this account retained the *Tillodonta* as a suborder, and referred *Esthonyx* to the *Insectivora*.

The *Tæniodonta* agree with the *Tillodonta* in the possession of a pair of inferior incisors of rodent character, but it adds several remarkable peculiarities. Chief among these is the character of the inferior canines. In the *Tillodonta* they are either wanting, as in *Erinaceus*, according to the Cuvierian diagnosis, or they are insignificant. In *Calamodon* they are of large size, and though not as long rooted as the second incisors, grow from persistent pulps. They have two enamel faces, the anterior and posterior, the former like the corresponding face of the rodent incisors. The function of the adult crown is that of a grinding tooth. This character distinguishes *Calamodon* as a form as different from *Tillotherium*, as the latter is from *Esthonyx*. There are, however, other characters. The external incisors, wanting in *Tillotherium*, are here largely developed, and though not growing from persistent pulps have but one, an external band-like enamel face. Their function is also that of grinders. The fact that the rodent teeth in the lower jaw are the second incisors, renders it probable that those of the *Tillodonta* hold the same position in the jaw. This is to be anticipated from the arrangement in *Esthonyx*, where the second inferior incisors are much larger than the first and third. The superior dentition of the *Tæniodonta* is unknown. There are two families, the *Ectoganidæ* with two species, and the *Calamodontidæ* with five species.—E. D. Cope.

¹ Report of U. S. Geol. Survey 40th Parallel by Clarence King, Vol. I, p. 377.

NEW FORMS OF CORYPHODONTIDÆ.—The Wasatch beds of the Big Horn basin have yielded several important additions to this family. Of eleven species found, two belong each to a new genus, and one is a novelty of the little-known genus *Metalophodon*. The characters of the genera of the family may be stated as follows :

- I. Two internal cusps of the last superior molar.
- All the true molars with a developed posterior external ∇ *Manteodon*.
- II. One internal lobe of the last superior molar.
- a. Last superior molar with posterior external cusp.
- Anterior two molars with posterior external ∇ *Ectacodon*.
- aa. Last superior molar without external posterior cusp.
- †Anterior two molars with posterior external ∇ .
- Astragalus transverse, with internal hook *Coryphodon*.
- Astragalus subquadrate, without internal hook *Bathmodon*.
- ††First superior molar only with posterior external ∇ *Metalophodon*.

The type of *Manteodon* is the *M. subquadratus*, which was about the size of an ox. The characters of its superior molars are more like those of Perissodactyles than are those of the other *Coryphodontidæ*. The type of *Ectacodon* is the *E. cinctus*, a species of about the dimensions of the last named. Its last superior molar is parallelogrammic, and has a cingulum all around it except on the external side. Of *Coryphodon*, a species larger than any yet known has been abundantly found by Mr. Wortman, which I call, in a paper now passing through the press, *C.anax*. The new *Metalophodon* is as large as the *Ectacodon cinctus*, and has the second true molar more triangular and less oval than in the type *M. armatus*. The posterior external ∇ of the last molar, is reduced to a cone. I have called it *M. testis*.—*E. D. Cope*.

AN ANTHROPOMORPHOUS LEMUR.—The stock from which the true quadrumana have been derived, is supposed to have been the lemurs, but no type of that sub-order has hitherto been found, which presents any near resemblance to either of the four families of monkeys. The two inferior families *Cebidæ* and *Hapalidæ*, agree with most of the *Lemuridæ* in having three premolar teeth, but those of the upper jaw generally have well developed internal lobes like the true molars, while most of those of the Lemurs have none. One group of Lemurs, the *Indrisinæ*, agree with the higher monkeys in having but two premolars, but these also are only one lobed.

A nearly perfect cranium of a species of *Anaptomorphus* Cope, shows that this genus had but two premolars in the superior series, as in the *Indrisinæ*, but that they are two lobed, as in the *Simiidæ* and *Hominidæ*. Of these two families, the *Hominidæ* is the one to which *Anaptomorphus* makes the nearest approach in dental characters. The canine is small with a crown little longer than those of the premolars, and is not separated from the latter or from the incisors by any appreciable diastema. All but one of the superior incisors are lost from the specimen, but those of the

lower jaw, which I discovered in 1872, were nearly erect as in man and the *Simiida*, and not procumbent as in most Lemurs. The cerebral hemispheres are remarkably large for an Eocene mammal, extending to between the middles of the orbits; the anterior parts, at least, are smooth. The cerebellum projected beyond the foramen magnum posteriorly, as in *Tarsius*. The orbits are large, approaching those of *Tarsius*, but are not so much walled in by a septum from the temporal fossa as in that genus. The superior molars have only one internal cusp.

The species, which I propose to call *Anaptomorphus homunculus*, has a wide palate much as in man, and the true molar teeth diminish in size posteriorly. The pterygoid and zygomatic fossæ are short and wide, and the petrous bone is large and inflated. The animal was nocturnal in its habits and was the size of a marmoset. The genus is nearer the hypothetical lemuroid ancestor of man than any yet discovered.—*E. D. Cope*.

THE ARCHÆAN ROCKS OF GREAT BRITAIN.—Professor Hull, director of the Geological Survey of Ireland, discriminates two petrographic types in the British Cambrian beds, the one consisting of purple sandstones or conglomerates, the other of hard green and purple grits and slates. The former is the "Caledonian" type, and is found in the north-west Highlands of Scotland. The second is the Hiberno-Cambrian, and characterizes East Ireland and North Wales. Professor Hull thinks these formations were deposited in distinct basins, which were separated by an Archæan ridge of crystalline rock which extended from Scandinavia, through the central Highlands of Scotland to Northwest Ireland. The Caledonian basin was an inland lake, the crystalline rocks of the outer Hebrides forming its western shore. Professor Hull also finds the Laurentian granite in N. W. Ireland overlaid unconformably by the Lower Silurian quartzite schists and limestones.—*Geological Magazine*.

A NEW BRITISH FORMATION.—The name Devonian-Silurian is given by Professor E. Hull to a series of cotemporary deposits found in various parts of the British Isles, and to some extent on the continent. He finds them in Devonshire and on the Welsh borders, and probably concealed in Southeast England; also, in the south of Scotland and North and South Ireland. The beds were deposited under estuary or lacustrine conditions, and constitute a great group between the Silurian on the one hand, and the Devonian on the other.—*Geological Magazine*.

RECENT EXTINCTION OF THE MASTODON.—The existence of the mastodon in North America must have been more recent than commonly supposed. A number of new facts bearing on this subject are to be found in Professor John Collett's "Geological Report of Indiana for 1880," recently issued. Of the thirty individual specimens of the remains of the mastodon (*Mastodon giganteus*) found in Indiana, in almost every case a very considera-

ble part of the skeleton of each animal proved to be in a greater or less state of decay. The remains have always been discovered in marshes, ponds, or other miry places, indicating at once the cause of the death of the animal and the reason of the preservation of the bones from decay. Spots of ground in this condition are found at the summit of the glacial drift or in "old beds" of rivers which have adopted a shorter route and lower level; consequently, their date does not reach beyond the most recent changes of the earth's surface. In fact, their existence was so late that the only query is, says Professor Collett: Why did they become extinct? A skeleton was discovered in excavating the bed of the canal a few miles north of Covington, Fountain county, in wet peat. The teeth are in good preservation, and Mr. Perrin Kent states that when the larger bones were cut open the marrow, still preserved, was utilized by the bog-cutters to "grease" their boots, and that pieces of sperm-like substance, two and a-half inches to three inches in diameter (adipocere) occupied the place of the kidney fat of the monster. During the past summer of 1880 an almost complete skeleton of a mastodon was found six miles north-west from Hoopston, Iroquois county, Illinois, which goes far to settle definitely that it was not only a recent animal, but that it survived until the life and vegetation of to-day prevailed. The tusks formed each a full quarter of a circle, were nine feet long, twenty-two inches in circumference at the base, and in their water-soaked condition weighed one hundred and seventy-five pounds. The lower jaw was well preserved, with a full set of magnificent teeth, and is nearly three feet long. The teeth, as usual, were thickly enameled, and weighed each from four to five pounds. The leg-bones, when joined at the knee, made a total length of five and a-half feet, indicating that the animal was not less than eleven feet high, and from fifteen to sixteen feet from brow to rump. On inspecting the remains closely, a mass of fibrous, bark-like material was found between the ribs, filling the place of the animal's stomach. When carefully separated, it proved to be a crushed mass of herbs and grasses, similar to those which still grow in the vicinity. In the same bed of miry clay a multitude of small fresh-water and land shells were observed and collected. These were: 1, *Pisidium*, closely resembling *P. additum* Haldeman; 2, *Valvata tricarinata* Say; 3, *Valvata*, resembling *V. striata*; 4, *Planorbis parvus* Say. These mollusks prevail all over the States of Illinois, Indiana and parts of Michigan, and show conclusively that, however other conditions may differ, the animal and vegetable life, and consequently climate, are the same now as when this mastodon sank in his grave of mire and clay.

THE MESOZOIC OF VIRGINIA.—Professor Fontaine gives a pretty full account of the geology of the Mesozoic of Virginia, with explanations of its peculiar features. He "has a very large collection of fine plants, many of them are new, and some

exceedingly fine. The collection is a pretty fair representation of the flora of the older Mesozoic, and will throw light on the Mesozoic of North Carolina and Pennsylvania. The secretary communicated the following notes by Professor Fontaine, made in the same letters: Upon the views of H. C. Lewis, respecting the Saltville valley in Southern Virginia, published in the Proceedings, No. 107, page 155. Mr. Fontaine points out that the little salt and gypsum bearing valley of Saltville cannot be "eroded along an anticlinal of Lower Silurian limestone, because the south-east wall hills only are of that age, while north-west wall hills are of the Umbral (Mauch Chunk or Sub-carboniferous) age." He was the first to find in the limestone on that side of the valley an abundance of Umbral fossils in the highly fossiliferous shale beds intercalated between the various limestones. The species are the same as those found near Lewisburg, West Virginia, in the Umbral. The magnesian (Lower Silurian) limestone strata, bounding the valleys on the south-west, show no trace of fossils. The physical aspect of the two formations also differs. Beds of shale and limestone alternate in the hills north-west of the valleys; and some of the limestone is cherty and some of the shales are red. But the south-east hills contain only solid limestone strata. Those on the north-west have a more rounded typography. It is, however, quite true that the stratification is in opposite south-east and north-west directions, gently to the south-east, much steeper to the north-west. The structure is, therefore, anticlinal, and this fault must run along the south-east edge of the little valley. The explanation is then simple, the Umbral limestone is synclinal, and the red shale formation comes up on both sides of it—with north-west dip in the little valley, with a south-east dip in the valley of the Holston river at the foot of the mountain. A reference to the place in the Michigan salt group in the Palæozoic series makes the presence of salt here easily understood. The horizon seems to be salt-bearing in other places in Southern Virginia. There is a salt ooze near Max Meadows, at the above geological horizon. The secretary suggested in addition to the underlying Vespertine (Pocono) sandstone is a salt-producing formation on the Ohio river and up country. That the gypsum is an acid reaction upon the eroded out-crops of the limestone, is shown in Proceedings A. P. S., Vol. ix, pp. 34, 1862.—*American Philosophical Society.*

GEOLOGICAL NEWS.—Messrs. Wachsmuth and Springer are publishing in the Proceedings of the Philadelphia Academy a revision of the *Palæocrinoidea* which will prove of great value to students. It is accompanied by numerous plates.—Professor Heilprin continues his researches on the Tertiary Geology of the Southeastern United States.—Edward Wethered, F.C.S., F.G.S., has communicated an important memoir on the formation of coal,

of which an abstract is given in the October, 1881, Geological Magazine of London.—The Bulletin of the Geological Society of France for 1881, contains many important memoirs, principally relating to the geology of France, Algiers and Belgium.—An analysis of the structure and age of the formations about Lake Champlain is given in the same periodical, by Professor Marcou.—Dr. Lemoine has added many important discoveries to those he has previously made in the Lower Eocene near Reims, France. He has procured almost perfect skeletons of the Mammalian genera *Heteroborus*, *Pleuraspidotherium*, *Pachynolophus*; of the bird *Gastornis*, and the reptile *Champsosaurus*. He has also discovered a number of the Marsupial family *Plagiaulacidae*, which is probably nearly allied to the *Phlodus*, described from New Mexico in the November, 1881, NATURALIST.—Professor Newberry criticizes adversely Professor Spencer's view on the Ancient outlet of Lake Erie, published by the American Philosophical Society.

MINERALOGY.¹

SYSTEMATIC MINERALOGY.—Bauerman. (Appleton & Co., New York, 1881.) The latest number of that excellent series known as the "Text-books of Science" consists of the first volume of a Text-book of Systematic Mineralogy, by H. Bauerman. The introduction states the two-fold object of the work to be that it should form (1) a guide to general students; (2) an elementary introduction to larger text-books. The greater part of the volume deals with the principles of crystallography. Not only are the simple and compound forms of the different systems fully described and illustrated, but by means of shaded figures, the origin of the hemihedral and tetartohedral modifications is explained. The optical properties of crystals are considered at length in some well written chapters, and the volume concludes with an elementary review of the physical and chemical characters of minerals. The descriptive portion of the work is not yet issued. We cannot help thinking that this work does not quite attain the object for which it was written. While not sufficiently thorough for the advanced student, the method of treatment is not such as would recommend it for the beginner. The language employed in a large portion of the book is by no means simple, and the practical performance of mineralogical work is but slightly considered.

LIME CRYSTALS IN A LIME-KILN.—Several years ago, Brugelmann succeeded in obtaining artificially microscopic cubes of

¹ Edited by Professor HENRY CARVILL LEWIS, Academy of Natural Sciences, Philadelphia. The Mineralogical Editor requests short original communications for publication in this department. Early copies of mineralogical papers printed elsewhere are also solicited for review.